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(54) **Apparatus and method for turning over a page in a book.**

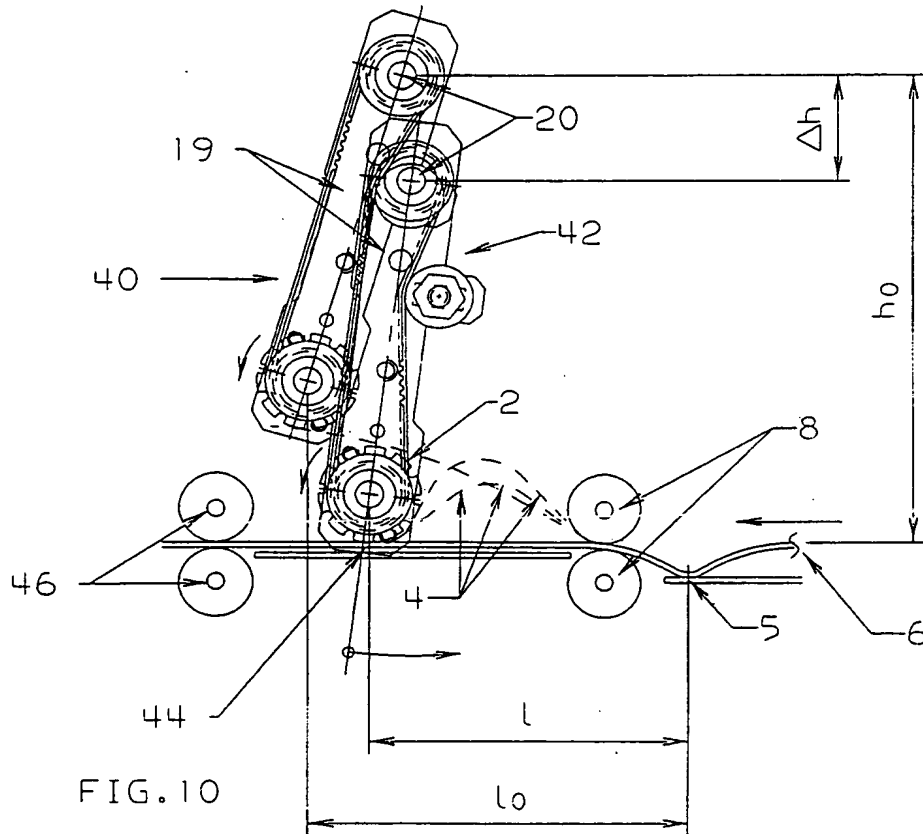
(57) An apparatus and method for turning over a page (4) in a book (6), preferably savings passbooks, is introduced which provides with reduced installation dimensions a minimized transportation distance of the book during turning the page, an optimized touching of the page lifting means on the page to be turned over, and the ability of turning over the pages in either direction.

The apparatus comprises lifting means (2) for lifting the page (4), a first transportation means (8) for transporting the book (6) in a horizontal direction substantially perpendicular to the joint (5) of the

book (6), and swivelling means (19) coupled to the lifting means (2) and being rotatable around a pivot (20).

The method comprises the steps of positioning a lifting means (2) comprising a rotating means (2) over the book (6), swivelling the rotating means (2) around a pivot (20) towards the book (6) rotating the rotating means (2) touchable to the page (4), and moving the rotating means (2) relative to the book (6) substantially in the direction of the joint (5) of the book (6) until the page (4) is turned over.

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### Field of the invention

The invention relates to an apparatus and a method for turning over a page in a book, preferably savings passbooks, comprising lifting means for lifting the page; and a first transportation means for transporting the book in a horizontal direction substantially perpendicular to the joint of the book.

Automatically turning over a page in a book has recently become an object in many kind of applications such as automatic book readers or book scanners or especially in passbook printers. The save and fast handling of the turning over process is the main condition of the entire process. Particularly, when confidential data are concerned, for example in banking applications, a reliable turning over process is necessary.

### Prior Art

EP-A-503476 (Hitachi) discloses a booklet printer and handling apparatus for use in a terminal device of a bank. A twistingly curved portion disposed obliquely relative to a direction of transfer of the booklet is provided at a booklet transfer passage. A page to be turned over by a page-turning roller is caused to strike against this twistingly curved portion.

In an article by A. Nishimoto titled "Auto Turn Page Mechanism for Passbook Printer", IBM Technical Disclosure Bulletin, vol. 30, no. 11, April 1988, a passbook printer is described having an auto turn page (ATP) feature in which a passbook page is automatically turned for printing transactions. The teaching of this article is the closest prior art and forms the preamble to claim 1.

For making the ATP mechanism by Nishimoto applicable to any thickness of page or any kind of passbook, the buckling load of the page must be controlled to meet the requirement of being larger than the frictional force between the pages. This is achieved by positioning the passbook to provide an appropriate distance  $l$  between the joint of the passbook and the point of touching of the page turning mechanism on the page, depending on the page or passbook. Each passbook is provided with data about the thickness of the page in the magnetic stripe applied thereon and, when the passbook is to be printed or turned over, the data is read and the passbook placed to provide the predetermined appropriate distance  $l$ .

Each page turning apparatus according to the prior art requires for the procedure of turning over the page a transportation distance of the passbook of at least two pages. The passbook has to be transported by transportation rolls for that transportation distance in order to support the page turning procedure by rolling the passbook back-

wards and forwards. Especially in modern passbook printer applications, space is limited and reduced space embodiments are demanded. Further more, especially at the start of each turning over procedure, the touching of the prior art rotating rollers on the page to be turned over opens a high possibility of damaging the page by bending and applying unacceptable forces to the page.

### Summary of the invention

It is therefore an object of the invention to provide an apparatus and method for turning over a page in a book providing a minimized transportation distance of the book during turning the page.

It is another object of the invention to provide an apparatus and method for turning over a page in a book providing an optimized touching of the page lifting means on the page to be turned over, especially at the start of each turning over procedure.

It is another object of the invention to provide an apparatus and method for turning over a page in a book providing the ability of turning over the pages in either directions.

It is yet another object of the invention to provide a compact apparatus for turning over a page in a book with reduced installation dimensions.

The objects of the invention are solved by swivelling means coupled to the lifting means and being rotatable around a pivot.

In an embodiment of the invention, the lifting means comprise rotating means and driving means for driving the rotating means. This allows a simple and low cost construction of the turning over mechanism.

In a further embodiment of the invention, the pivot is substantially movable in the horizontal direction and/or perpendicular to the horizontal direction. This allows a positioning of the lifting means on the page to be turned over independent from transportation means in order to reduce the transportation area of the passbook. It further enables an effective control of the applied forces of the lifting means on the page during and before the page lifting procedure.

A further embodiment of the invention further comprises a second transportation means for transporting the book in a horizontal direction substantially perpendicular to the joint of the book, the first and second transportation means being spaced apart in the horizontal direction. This allows turning over the pages in either direction without turning the book.

In a further embodiment of the invention, the pivot is located in an area between a first plane substantially perpendicular to the horizontal direction through a first one of the transportation means,

and a second plane substantially perpendicular to the horizontal direction through a second one of the transportation means. This is advantageous in order to reduce the installation dimensions.

The object of the invention is solved by a method comprising the steps of positioning a lifting means comprising a rotating means over the book, swivelling the rotating means around a pivot towards the book, rotating the rotating means touchable to the page, and moving the rotating means relative to the book substantially in the direction of the joint of the book until the page is turned over.

The method of another embodiment of the invention further comprises a step of quickly striking the lifting means on the book. This unsticks the pages and therefore avoids an incorrect turning over of several pages.

The method of another embodiment of the invention further comprises a step of positioning the book under the lifting means, whereby the book is transportable by transportation means in a substantially horizontal direction perpendicular to the joint of the book. This allows a combined positioning of the lifting means relative to the page by means of the swivellable lifting means and the transportation means.

In another embodiment of the invention the step of rotating the rotating means touchable to the page is carried out at least until the page is lifted. This enables a save lifting of the page over the rotating means.

In another embodiment of the invention the force applied by the lifting means on the page and/or the time of the applied force is adjustable. This allows a flexible process which is adoptable to each variation in the characteristics of the book and in the characteristics of the turning over apparatus.

The invention will now be described by way of example and with reference to the accompanying drawings.

#### Description of the drawings

Fig. 1 to Fig. 8. show in a sequence the steps of turning over a page,

Fig. 9 illustrates the page turning over mechanism according to the invention,

Fig. 10 shows the principals of turning over a page of an embodiment according to the invention,

Fig. 11 shows the turning over apparatus of Fig. 10 turning over the page in the other direction.

#### Detailed description of the invention

The steps of turning over a page is shown in the sequence of Fig. 1 to Fig. 8. A friction roller 2 as the lifting means is brought into contact with the

page 4 at a distance  $l$  from the joint 5 of a book 6, whereby  $l$  depends on the thickness or persistence of the page 4 to turn it over without turning multiple pages. Then, friction roller 2 is rotated to frictionally incurvate and flip up the page 4 on the friction roller 2. Next (Fig. 8), the book 6 is moved by transportation rollers 8 to turn over the page 4.

Fig. 9 illustrates the page turning over mechanism according to the invention. Friction roller 2 is linked to a pivot roller 10 through a first rigid link 12 and driven by a motor 14 by a belt 16 and 18, whereby the pivot roller 10 is driven by the belt 16 from the motor 14 and pivot roller 10 further drives friction roller 2 by belt 18. A linkage 19, consisting of the friction roller 2, the first rigid link 12 and the pivot roller 10, is swivellable around a center of motion 20, which is also the center of rotation for the pivot roller 10.

The first rigid link 12 is linked to an excenter 22 through a link 24 in order to deflect the friction roller 2 around the center of motion 20 by means of a rotation of excenter 22 around an excenter pivot 26.

The pivot roller 10 is connected to a case 28 by a spring 30, whereby the case 28 is relatively fixed with respect to the turning over mechanism. Accordingly, the center of motion 20 of the linkage 19 is variable in height relative to the book 6. This variation in height can be accomplished by a hoisting motor 32, which is coupled by a second rigid link 34 to the excenter 22, the motor 14 and the center of motion 20 of the linkage 19. When the hoisting motor 32 drives out or in in a horizontal direction, the second rigid link 34 is rotated around a link pivot 36, which is preferably also the pivot of the motor 14. The rotation around the link pivot 36, caused by the hoisting motor 32, also rotates the center of motion 20 around the link pivot 36. The radius of the center of motion 20 to the link pivot 36 is preferably greater than the point of application of the hoisting motor 32 on the second rigid link 34 to the link pivot 36. Thus, the position of the center of motion 20 is changeable around the link pivot 36, and therefore in the horizontal and vertical direction with respect to the book 6.

~~It is to be understood that the above described~~ arrangement allows a variety of possibilities of different applications. Due to the swivellable linkage 19 in combination with the height control and the possibility of a horizontal moving of the center of motion enabled by motor 32, two basic functions can be fulfilled as described below.

A first function of the arrangement is to reduce the required transportation area of the book 6 during the turning over procedure. The book 6 only needs to be brought into a book start position which depends on the direction of turning the page as apparent in Figs. 10 and 11. The fine positioning

of distance  $l$  between the touching point of friction roller 2 on the page and the joint 5 of the book is then executed by positioning the friction roller by means of the swivellable linkage 19 or the height control by motor 32 or a combination of both.

A second function of the arrangement, which can be in combination with the first function, is to achieve a frictioned but light contact between the friction roller 2 and the page to be turned during the starting-up of the turning over procedure. This is realisable by the tangential force of the rotating linkage 19 in combination with a vertical force applied due to a change in height by motor 32.

It is clear that the variations in height and driving the friction roller 2 can be accomplished by any other means known in the art. However, it will be appreciated by those familiar in the art that the suggested solution is very easy to establish and allows small dimensions for the installation of the page turning over mechanism. Furthermore, the center of motion 20 can also be movable in a direction parallel to the transportation direction of the book 6.

In the following, a method for turning over a page will be explained as an example. It is clear that some of the steps can be executed in a different sequence dependent on the specific situation and problems to be solved.

Fig. 10 shows the principals of turning over a page in an embodiment according to the invention. The book 6 is positioned as shown in a way that the page 4 to be turned over is underneath the linkage 19 and in the example of Fig. 10, the linkage 19 is left from the joint 5 of the book 6. The book 6 is substantially fixed in that position during the turning over procedure. The linkage 19 is then deflected into a start position 40 above the page 4 to be turned over. The center of motion 20 in the start position 40 is at a height  $h_0$  above the book 6 while the distance between the joint 5 of the book and the touching point of the friction roller is  $l_0$ .

Especially when new books are used for the first time the pages might stick together as a result of the cutting process during manufacturing. Also, when the books are frequently used, the pages are likely to stick together due to dust and dirt between the pages. In order to unstick and detach the pages, a preferred embodiment comprises an unstick procedure. Before the friction roller 2 starts the turning over procedure, the linkage 19 is quickly struck onto the pages. Preferably, the striking is executed with the rotating friction roller 2 from the start position 40. In most cases, the striking results in an acceptable unsticking and detaching of the pages.

In order to start the page turning over procedure, the linkage 19 will be positioned in a turning over position 42 in which the friction roller 2 is

placed into contact with the page 4 to be turned over. The positioning can be executed simply by changing the height of the linkage 19 over the book 6, but is preferably done by a combination of the rotating linkage 19 around the center of motion 20 in direction of the page 4 and changing the height over the book by means of the motor 32. It was found that an optional rotation of the friction roller 2 during the positioning resulted in a good performance of the turning over procedure, whereby the direction of rotation of a lower surface 44 of the friction roller 2 must be the same as the direction of rotation of the linkage 19 towards the page 4, for example in Fig. 10 anti-clockwise.

The page turning over procedure is then executed in that friction roller starts rotating, whereby the direction of rotation of the lower surface 44 of friction roller 2 is in the direction of the joint 5 of the book, in Fig. 10 anti-clockwise. According to the sequence in Figs. 3 to 7, the page 4 to be turned is lifted by the frictional force of friction roller 2 until the page 4 has the position as shown in Fig. 7 that the page 6 is fully lifted over the friction roller 2. Transportation rollers 8 then move the book 6 in the direction of friction roller 2 until the page 4 is finally turned over.

As apparent in Fig. 5, friction roller 2 is lifted when the lifted page 4 exceeds a certain height, determined by a light barrier (LB) or such like. Friction roller 2 continuously rotates until the page 4 is eventually found in the position according Fig. 7.

In an embodiment of the invention, the page turning over procedure as described above is executed within a time limit, whereby the time limit is set so that the turning over procedure can be executed in case of a standard book and a nominal working of the turning over apparatus. When the time limit is exceeded, the position of the page 4 to be turned is checked by optical controllers. If the page 4 is not found in a position of being lifted from the book 6 (e.g. according to Fig. 7), the system realizes that the turning over procedure was not successful and has to be repeated again until the page 4 is eventually turned over. In a preferred embodiment the force on the page 4 will be increased gradually each time the procedure is repeated. When the force on the page exceeds a certain level or a certain number of repetitions is reached, the turning over procedure will be stopped and an error signal is applied to a control unit.

Fig. 11 shows the turning over apparatus of Fig. 10 turning over the page in the other direction. The apparatus according to the invention allows turning over the pages in both directions by simply turning linkage 19 around the center of motion 20. Accordingly, book 6 is positioned by a transportation rollers 46 shown in Fig. 11 with the joint 5 of the book substantially symmetric to the center of

motion 20 and the arrangement of the joint 5 in Fig. 10. In the example of Fig. 11, the linkage 19 is right from the joint 5 of the book 6. The procedure of turning over the page in the other direction is according to the procedure explained above, whereby the turning directions are opposite.

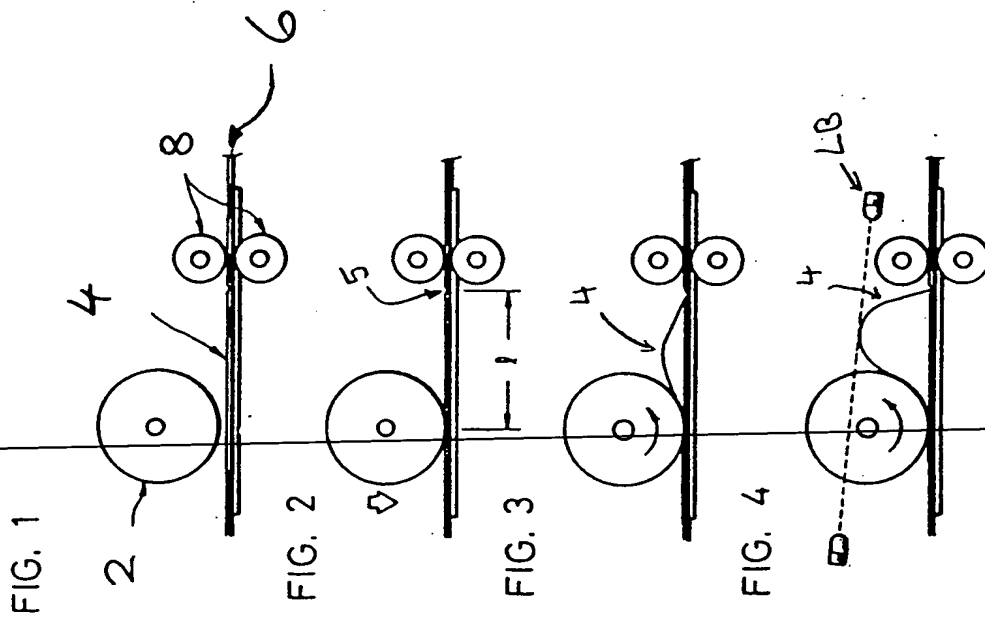
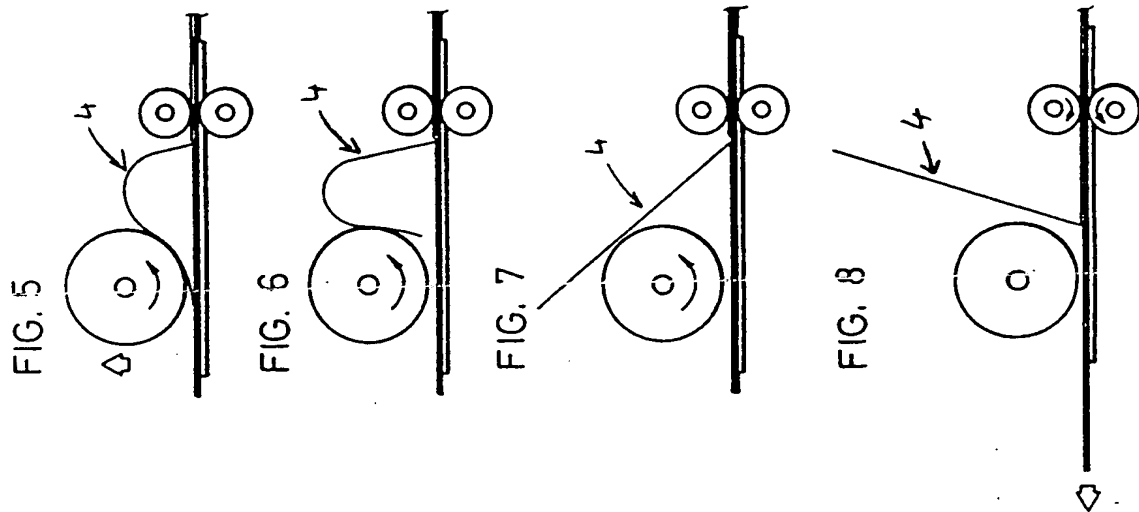
As apparent from above description, the invention is not limited to any type of books but is preferably applicable for savings passbooks in passbook printer applications or other kind of booklet printers. Furthermore, the teaching of the invention is also applicable and useful for any kind of automatic book readers or book scanners.

#### Claims

1. Apparatus for turning over a page (4) in a book (6), comprising:  
lifting means (2) for lifting the page (4); and  
a first transportation means (8) for transporting the book (6) in a horizontal direction substantially perpendicular to the joint (5) of the book (6);  
characterized by  
swivelling means (19) coupled to the lifting means (2) and being rotatable around a pivot (20).
2. The apparatus according to claim 1 characterized in that  
the lifting means (2) comprise rotating means (2) and driving means (14) for driving the rotating means (2).
3. The apparatus according to claim 1 or 2 characterized in that  
the pivot (20) is substantially movable in the horizontal direction and/or perpendicular to the horizontal direction.
4. The apparatus according to any one of the above claims characterized by further comprising  
a second transportation means (46) for transporting the book (6) in a horizontal direction substantially perpendicular to the joint (5) of the book (6), the first (8) and second (46) transportation means being spaced apart in the horizontal direction.
5. The apparatus according to any one of the above claims characterized in that  
the pivot (20) is located in an area between  
a first plane substantially perpendicular to the horizontal direction through a first one of the transportation means (8), and  
a second plane substantially perpendicular to the horizontal direction through a second

one of the transportation means.

6. Method for turning over a page (4) of a book (6) comprising the steps of:  
positioning a lifting means (2) comprising a rotating means (2) over the book (6);  
swivelling the rotating means (2) around a pivot (20) towards the book (6);  
rotating the rotating means (2) touchable to the page (4);  
moving the rotating means (2) relative to the book (6) substantially in the direction of the joint (5) of the book (6) until the page (4) is turned over.
7. The method according to claim 5 further comprising a step of quickly striking the lifting means (2) on the book (6).
8. The method according to claims 5 or 6 comprising a step of positioning the book (6) under the lifting means (2), whereby the book (6) is transportable by transportation means (8) in a substantially horizontal direction perpendicular to the joint (5) of the book (6).
9. The method according to any one of the above claims 5 to 7 whereby  
the step of rotating the rotating means (2) touchable to the page (4) is carried out at least until the page (4) is lifted.
10. The apparatus or method according to any one of the above claims characterized in that  
the force applied by the lifting means (2) on the page (4) and/or the time of the applied force is adjustable.
11. Use of the apparatus or method according to any one of the above claims in  
book printer applications, preferably savings passbook printers, or in automatic book reader applications such as an automatic book scanning apparatus.



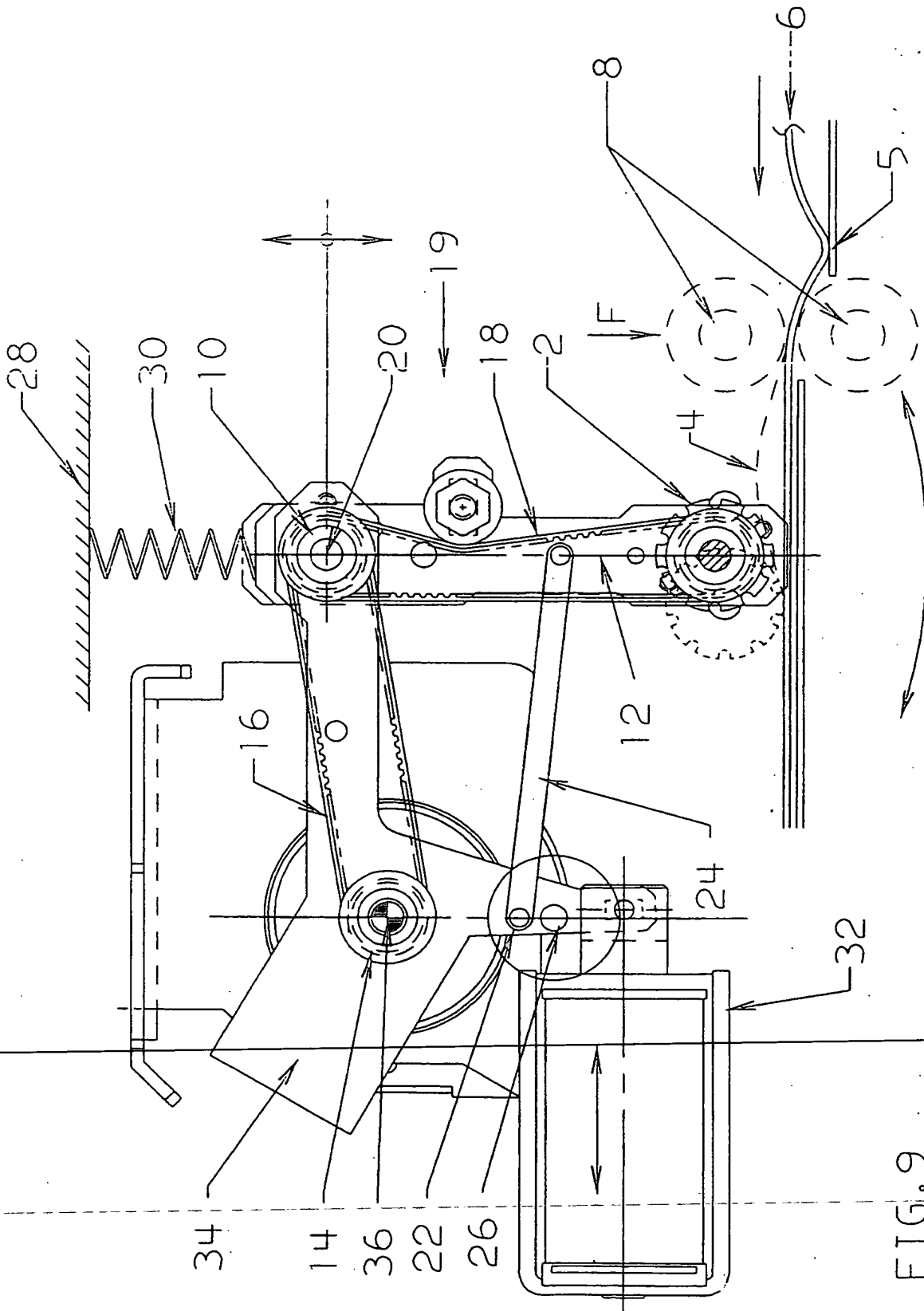
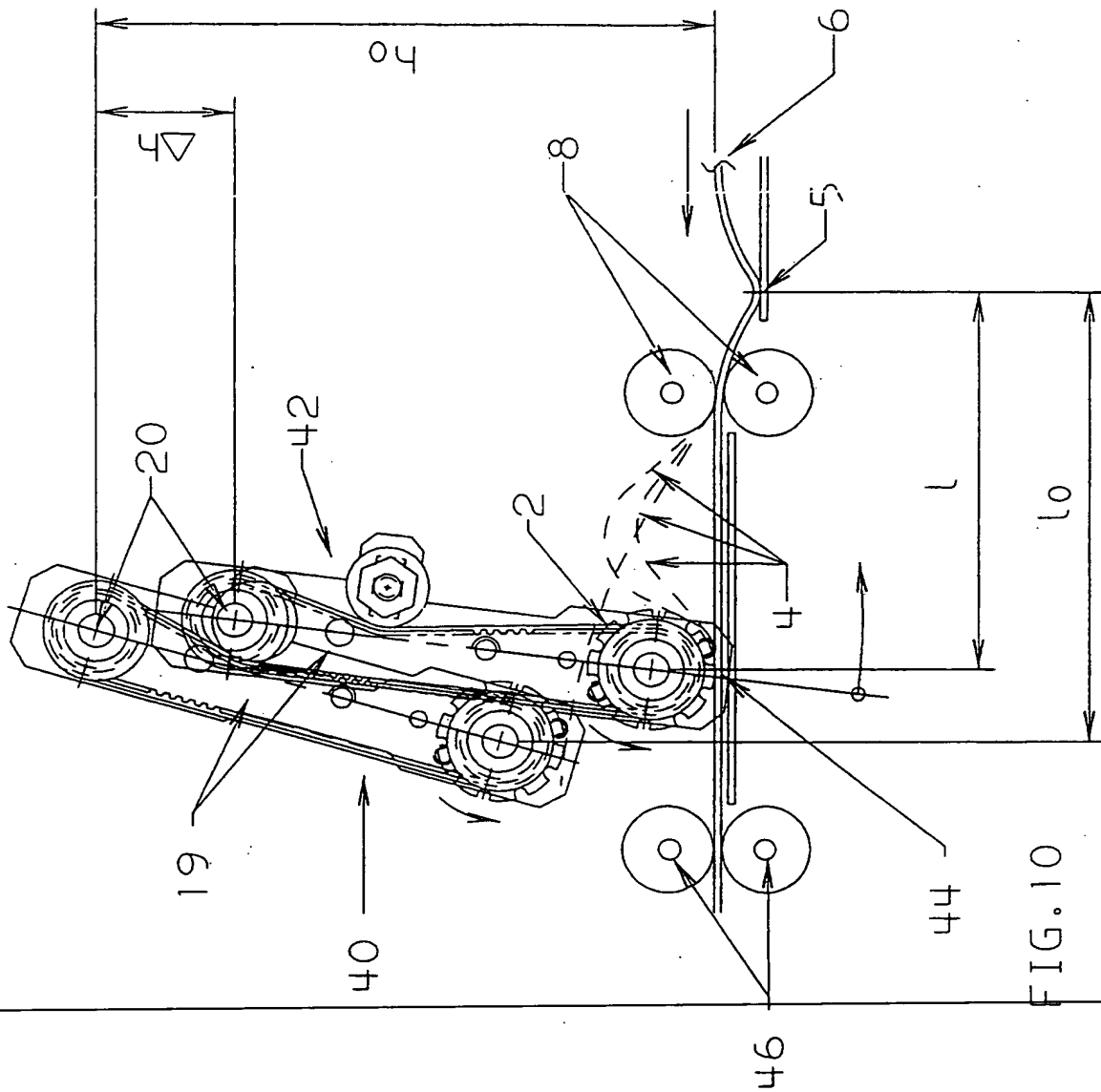


FIG. 9





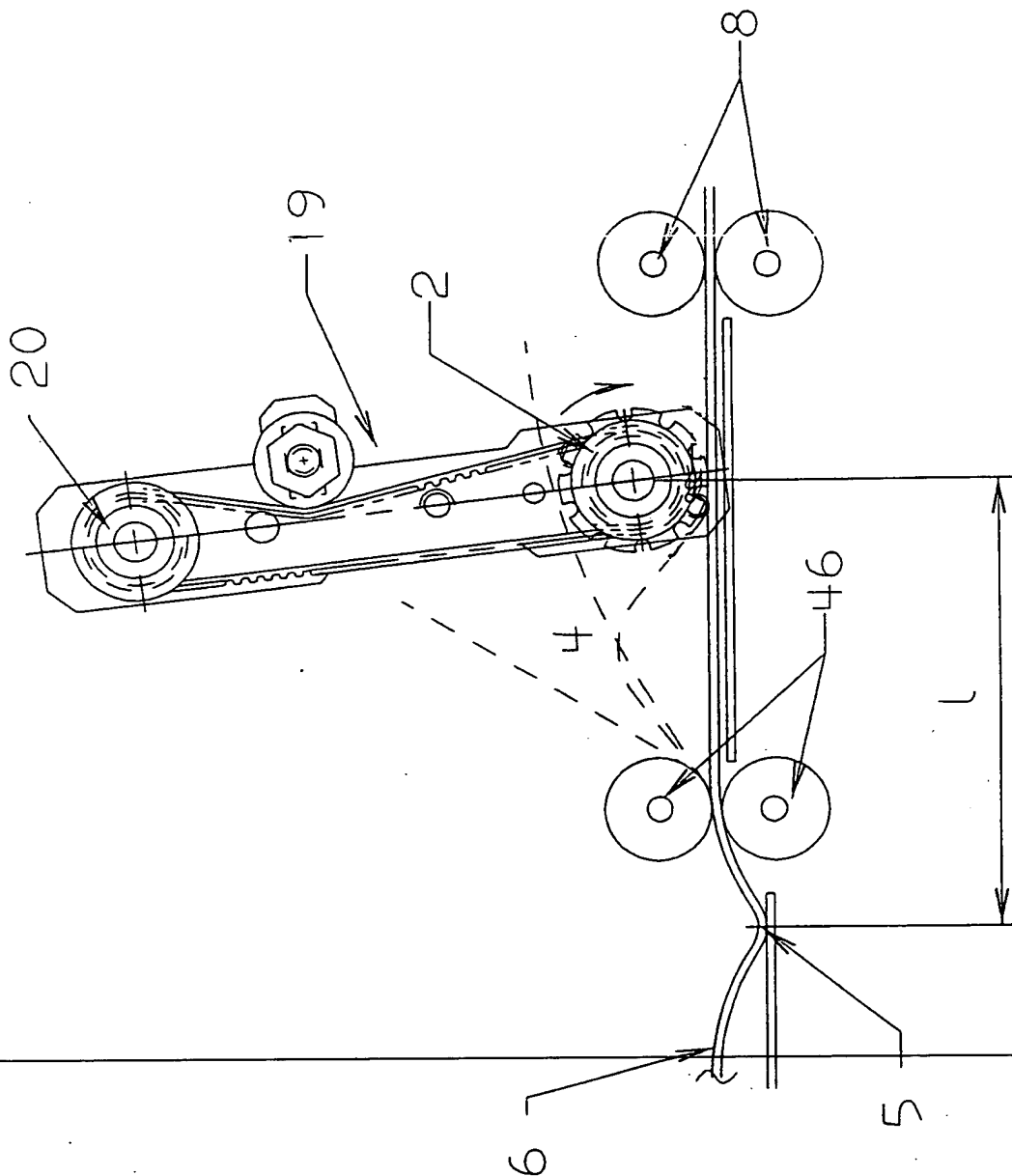


FIG. 11



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## EUROPEAN SEARCH REPORT

Application Number  
EP 94 10 8261

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	EP-A-0 459 438 (HITACHI LTD) * claim 1; figure 6 * ----	1-6,8-11	G07F7/10 B42D9/04
A	EP-A-0 235 458 (NCR CORPORATION) * claim 1; figure 1 * ----	1-11	
A	EP-A-0 439 934 (KABUSHIKI KAISHA TOSHIBA) * claim 1; figure 1 * ----	1-11	
A	US-A-4 870 258 (MOCHIZUKI ET AL) * claim 1; figure 4 * ----	1-11	
A	GB-A-2 222 819 (HITACHI LTD) * claim 1; figure 1 * -----	1-11	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			G07F B42D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 19 October 1994	Examiner Kirsten, K
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document	